Stream Candidate Recommendations for Thermal Performance Curve Modeling and Stream Temperature Management

Overview

Due to the construction of large impassable barriers such as hydroelectric dams, the amount of stream habitat available to anadromous fish in the California Central Valley has declined dramatically over the past 100 years. This has severely affected anadromous fish populations in a variety of ways including displacement from historic spawning/rearing habitat, changes in thermal regimes, and an overall reduction in the amount of habitat for available spawning. Chinook salmon runs which historically spawned at different times and places in watershed are now constrained to the small amount of habitat available in the tailwaters below dams. Spring-run Chinook runs have been extirpated in many rivers in the Central Valley possibly due to the inability to access high-altitude tributaries where they historically spawned. Now multiple runs compete for spawning and rearing habitat, perhaps resulting in unnatural strain for resources on populations. Additionally, managers may attempt to regulate flow and temperature regimes that are optimized for a single run and or life stage; however, this may inadvertently inhibit another run. We propose here a set of candidate streams for Thermal Performance Curve Modeling which will help managers regulate flows to optimize conditions for the most vulnerable life stages or runs in a given stream when ideal temperatures cannot be met year-round.

Candidate Streams

We have provided a list of 22 candidate streams located in the California Central Valley (Table 1). These streams range in size and complexity but all contain populations of anadromous Chinook Salmon. As per the steering committee's suggestion, we will focus on streams

regulated by hydroelectric dams as they allow for a controllable response based on scientific information. We would also like to suggest the modeling of an additional two non-regulated streams as a baseline comparison for how streams in the Central Valley would naturally function without large dams. This will allow us to model natural hydrograph Thermal Performance Curves to help inform dam operators how to alter flow regimes to mimic natural habitats.

Stream Recommendations

Taking into consideration Chinook run timing and size, along with data availability and spatial distribution, we suggest the modeling effort be focused on the Yuba, Tuolumne, and Stanislaus Rivers. These rivers have intensive monitoring programs and do not have fish hatcheries so any population level responses would be directly related to environmental shifts as opposed to hatchery practices. The Yuba River still has a spring run population so alterations in flow regimes may directly benefit the recovery of this run. Due to recent increases in flow, spring run fish have returned to the main stem San Joaquin for the first time in 60 years; the Tuolumne and Stanislaus historically had spring run populations, and flow alteration could possibly help these populations reestablish as well. To establish baseline models for natural flows we plan to model Mill Creek in the Sacramento River watershed and the Cosumnes River. Mill Creek is one of the best remaining habitats for salmon in the north side of the valley, and the Cosumnes River is the largest unregulated river in the southern portion of the Central Valley.

Table 1. Candidate list of 22 streams in the Central Valley. Temperature monitors are from NorWest.

River	Fall	Spring	# Temp monitors	# km	Regulated	Migration Data	Spawn Data	Juvenile Data	Disease Data	Data Type
Merced River	X	O	4 (far ds of spawning grounds)	277	X		X		X	Carcass survey, fish distribution/redd counts
Tuolomne River	X	O	~4	258	X	X	X	X	X	Carcass survey, redd distribution, weir video monitoring, snorkal survey, beach seine, rotary screw trap
Stanislaus River	X	O	~4	157	X	X	X	X	X	Carcass survey, redd distribution, weir video monitoring, snorkal, seine, tagging
Mokelumne River	X	O	0	159	X	X	X	X		Video trap and monitoring, carcass survey, redd count/distribution, screw trap
Consumnes River	X		0				X	X		Carcass survey, screw trap, gaps in yearly monitoring
American River	X	O	3		X		X	X		Carcass survey, redd survey, screw trap
Auburn Ravine	X		0		X		X			Redd survey, gaps in yearly monitoring
Yuba River	X	X	~5	74	X		X	X		Carcass survey, Redd survey, limited screw trap data
Feather River	X	X	2 (far ds of spawning grounds)	125	X		X	X	X	Redd survey, carcass survey, screw traps, snorkal survey
Butte Creek	X	X	2	169	X	X	X	X		Carcass survey, snorkal survey, video monitoring, rotary screw traps
Big Chico Creek	X	X	2	83			X	X		Snorkel/Carcass survey, rotary screw trap
Sacramento River	X	O	Lots	652	X	X	X	X	X	Carcass survey, redd survey, screw traps, snorkal survey
Deer Creek	X	X	2	120		X	X	X		Carcass/redd survey, snorkal, video survey
Thomes Creek		X	2	145						
Mill Creek	X	X	2	104		X	X	X		Carcass, redd, snorkal, video survey, rotary screw trap
Antelope Creek	X	X	1			X	X			Snorkel survey, redd, bio survey, video monitoring
Cottonwood Creek	X	X	5			X	X	X		Carcass survey, Video monitoring, seine and rotary screw traps
Battle Creek	X	X	Lots	30						Carcass survey/ Snorkel redd survey, hatchery counting,
Bear Creek	X		2	37		X				Video monitoring
Cow Creek	X		1	90		X	X			Video monitoring, carcass survey
Clear Creek	X	X	13		X					Redd/Carcass survey, Video monitoring, rotary screw traps
San Joaquin River	X	X		568	X	X	X	X	X	Redd survey, carcass survey, screw traps, snorkal survey

Figure 1. Locations of suggested rivers and spring run spawning distribution (red). All five rivers have fall run. Spring run were extirpated along the Tuolumne and Stanislaus Rivers. Rivers are shown against a backdrop of Central Valley stream temperatures (preliminary results) for May, the peak month of spawning for spring run.